SEMESTER EXAMINATION, DECEMBER, 2025

Course Name: - B.Tech (CSE) **Semester:- 7TH**

Paper Name: - Digital Image Processing **Paper Code:- TCS 701**

Time - 3 Hrs + 20 minutes per hour extra time for V.I. & examinees with writer. **Max Marks-70**

समय– 3 घण्टे + 20 मिनट प्रति घंटे अतिरिक्त–दृष्टिबाधित एवं साह लेखक परीक्षार्थियों के लिए। अधिकतम अंक–70

Instructions:

- The question paper consists of three sections namely A, B, C. All sections are compulsory.
- Section A- Each question carries **3 mark. All questions are compulsory.**
- Section B- Answer any **5 out of 7** given questions. Each question carries **7 marks.**
- Section C- Answer any **2 out of 3** given questions. Each question carries **10 marks.**

निर्देश:

- प्रश्न पत्र में तीन खण्ड अ, ब, व स हैं। सभी खण्ड अनिवार्य हैं।
- खण्ड–अ में प्रत्येक प्रश्न **तीन अंक** का है। **सभी प्रश्न अनिवार्य हैं।**
- खण्ड–ब में **सात प्रश्नों में से किन्हीं पाँच** प्रश्नों के उत्तर दें। प्रत्येक प्रश्न **सात अंक** का है।
- खण्ड–स में **तीन प्रश्नों में से किन्हीं दो** प्रश्नों के उत्तर दें। प्रत्येक प्रश्न **10 अंक** का है।

Section – A (खण्ड–अ)

Multiple Choice Questions (बहुविकल्पीय प्रश्न)

1. Answer all the following questions. **5x3 =15**
निम्नलिखित सभी प्रश्न अनिवार्य हैं।

i) Which of the following is NOT a component of an image processing system?
a) Image Acquisition
b) Image Restoration
c) Image Perception
d) Storage

ii) Which of the following is true about Gaussian low-pass filters?
a) They are ideal for edge enhancement
b) They have sharp cut-offs in the frequency domain
c) They provide smooth transitions between frequency components
d) They amplify high frequencies

iii) Which of the following is NOT a common noise model in image restoration?
a) Gaussian noise
b) Salt-and-pepper noise
c) Exponential noise
d) Poisson noise

iv) Which of the following is an additive color model?
a. CMY
b. HSV
c. YUV
d. RGB

v) Run-Length Coding is most effective for:
a. Images with smooth gradients
b. Binary images or images with large homogeneous regions
c. Highly textured images
d. Images with high contrast

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Section – B (खण्ड–ब)
Short Answer Questions (लघुउत्तरीय प्रश्न)

2. Answer any five of the following questions. **5x7=35**
निम्नलिखित में से किन्हीं पाँच प्रश्नों के उत्तर दें।

(i) Explain image sharpening using Laplacian operator

(ii) Define image compression? Write the difference between Image and Data compression?

(iii) Explain the process of filtering and compare all filtering methods.

(iv) Compare and contrast Huffman coding and arithmetic coding in terms of efficiency and applications.

(v) Identify and explain various noise models present in degraded images and elaborate on suitable restoration approaches for each.

(vi) Why we Use Histogram Specification? How Histogram Specification Works?

(vii) Describe the concept of minimum mean-square error (MMSE) based image restoration and explain how it is applied to reduce image degradation.

Section – C (खण्ड–स)
Descriptive Questions (विवरणात्मक प्रश्न)

3. Answer any two of the following question. **2x10=20**
निम्नलिखित में से किन्हीं दो प्रश्नों के उत्तर दें।

(i) Differentiate between lossless and lossy compression and explain transform coding system with a neat diagram.

(ii) Discuss smoothing and sharpening filters in the frequency domain. Explain Gaussian low-pass and high-pass filters and their applications.

(iii) **Scenario:** A smart traffic control system analyzes camera images to identify red, yellow, and green traffic lights throughout the day. During early morning and late evening hours, the system frequently misclassifies signal colors when images are processed in the RGB color space.

Question: Analyze the limitations of the RGB color model in varying illumination conditions. Explain how using a color model that separates brightness from chromatic information improves robustness in traffic signal detection.

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